

PTB 04 ATEX 1027

KAM® CHA™ COLORIMETER/HAZE ANALYZER

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User Manual
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CAUTION:

When installing the CHA™ sensor in a pipeline containing petroleum products, petro-chemicals, waste waters with the presence of pressure & temperature, and high-pressure steam refer to the Pipeline Operators' "Health, Safety and Environmental Policy Procedures" to ensure safe installation.

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INTRODUCTION

AVAILABLE MODELS and MOUNTING OPTIONS

FIG. 1-1

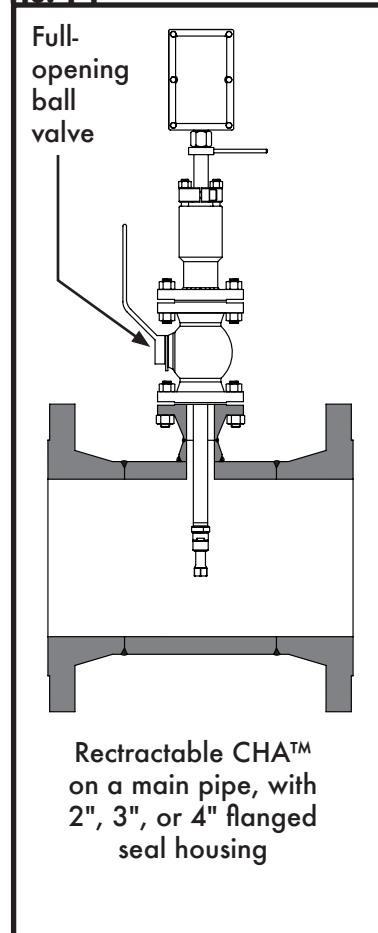


FIG. 1-2

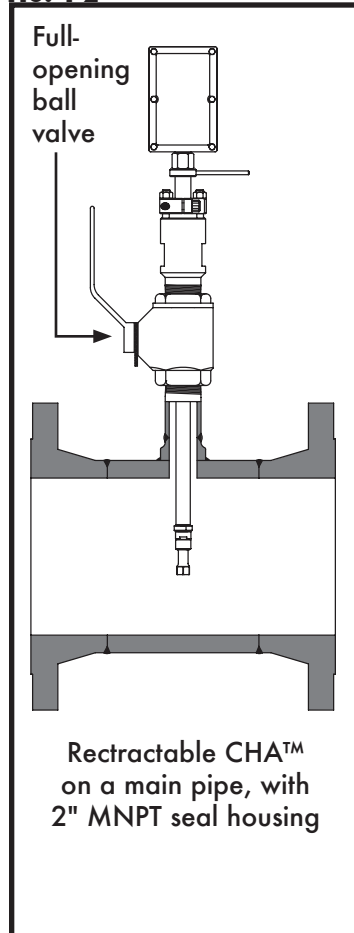
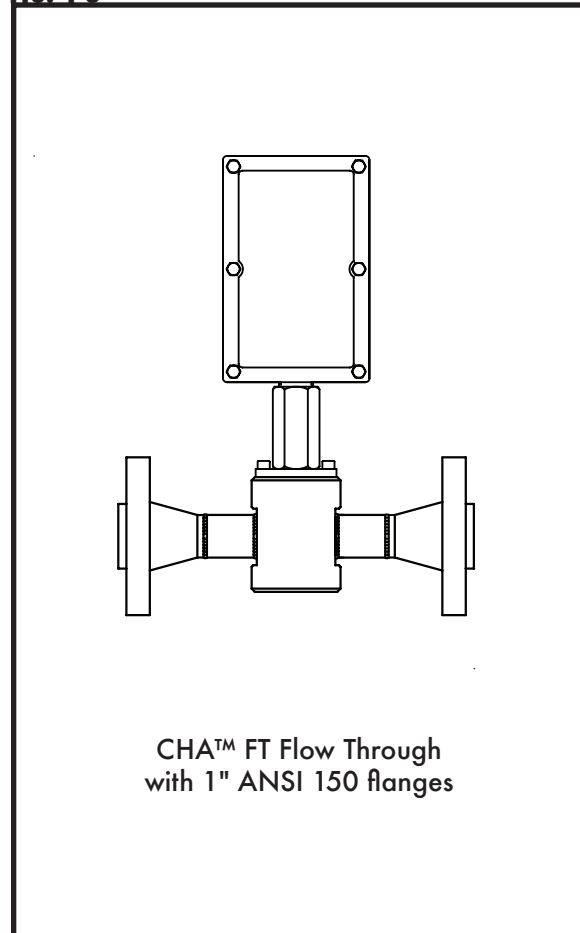


FIG. 1-3



THEORY OF OPERATION

Color variations in refined products indicate impurities and/or the presence of water. Refined products are often prone to haze or diffused water contamination due to cooling towers which use water and in turn can saturate the product. This can be a significant liability as color differentiation can be easily detected by the end user. The KAM® CHA™ Colorimeter/Haze Analyzer is the ideal quantitative solution for monitoring both the color of refined products, including dyed product, and the presence of haze (trace/dissolved water) in pipelines following the refining process. The KAM® CHA™ detects interface color variations within 1%, and unlike most colorimeters can detect the entire range of visible color as defined by CIE 1931 (International Commission on Illumination). The simplicity of design and quality of engineering employed in the Colorimeter/Haze Analyzer mean there are no moving parts. Using long-lasting LED light sources ensures long-term, stable performance with limited maintenance and power requirements. In addition, locating the electronics within an explosion-proof enclosure directly on the atmospheric end of the optical probe creates a complete and compact unit with maximum installation flexibility. The KAM® CHA™ easily installs where other colorimeters, weighed down by large electronics/computer units, cannot.

The five LED sources (Red, Blue, Green, Yellow, and IR) send light via fiber optics to the sensor end inserted into the pipeline or analyzer loop. These beams of light pass through a 25mm window of pipeline fluids and then are reflected back through fiber optics to the electronics enclosure for a total path of 50mm.

INTRODUCTION CONTINUED

KAM uses four LED's for color determination to increase the accuracy over three-color (RGB) models. The fifth (IR) LED provides haze detection. The disparity in light output versus light reflected back is then converted into an electronic or optical signature which is amplified and sent to the computer. The computer in turn utilizes a mathematical formula to determine the exact color and haze (turbidity) of the fluid in the pipeline. Final color measurement from the KAM® CHA™ can be expressed as haze plus three color (X, Y, Z, CIE 1931) or in several other industry-standard color scales including, Saybolt, Platinum and Cobalt, and ASTM 1500 (see Specifications, Section 2).

The computer automatically adjusts for electronic noise and any LED fluctuations. Because the absorption rates of the different colored fluids vary resulting in different signal strengths, the computer also automatically adjusts the amplification or gain accordingly.

Measurement is fully automatic without the need for operator intervention or supervision. The output signal can be sent to the SCADA, PLC's, or to a Central Control Room for logging or display on chart recorders or monitors.

The KAM® CHA™ probe can be installed in an analyzer loop or in the main line, and because it's easily mounted through a full-opening ball valve, you can insert or retract the probe without having to ever drain the pipe.

FEATURES

- User friendly
- Low power
- Explosion proof
- Low maintenance
- Compact format includes requisite electronics
- Long-lasting LED light sources

APPLICATIONS

- Batching
- Interface
- Production
- Transmix/regrade reduction
- Quality control in refined products including dyed and undyed motor and aviation gasoline, jet propulsion fuels, naphthas and kerosine
- Quality control in pharmaceutical white oils and petroleum waxes
- Brine detection in LPG transfer from storage caverns

SPECIFICATIONS

| | |
|--------------------------|--|
| Media: | Refined products |
| Material: | Wetted parts–316 stainless steel, sapphire |
| Power: | 12–24 VDC 20 Watts max |
| Communication Interface: | RS-485 reflects values for Haze plus designated color scale (see Color Range) |
| Fluid temperature: | -40° to 200°F (-40° to 93°C) |
| Electronics temp.: | -22° to 185°F (-30° to 85°C) |
| Pressure ratings: | ANSI 150, 300, 600 |
| Accuracy: | Haze \pm 5%, Color \pm 1% |
| Repeatability: | Haze \pm 1%, Color \pm 1% |
| Reproducibility: | Haze \pm 1%, Color \pm 1% |
| Haze Range: | 0-100% |
| Color Range: | Complete range of: ASTM D 1500; ASTM D 156 (Saybolt); ASTM D 1209 (APHA Platinum-Cobalt) |
| Mounting: | 3/4", 1", 1 1/2", and 2" FNPT Flow Through (Metric sizes available) 2" MNPT Seal Housing 2", 3", or 4" Flanged Seal Housing |
| Sensor Dimensions: | 3.5" x 1.25"Ø (90mm x 32mm), Flow through 5.8" x 2.75"Ø (148mm x 70mm) |
| EX enclosure: | 3" x 6" x 3" (76mm x 152mm x 76mm) |
| Shaft length: | 12" to 60" – Off-the-shelf lengths are 12", 24", 36", 48", and 60" (305mm to 1524mm) (Off-the-shelf 609.6mm, 762mm, 914.4mm, 1219mm, 1524mm) |
| Pipe size: | 3/4" to 48" (20mm to 1200mm) |
| Weight: | from 20 lbs. (9kg) |

SPECIFICATIONS CONTINUED

DIMENSIONAL DRAWINGS

FIG. 2-1 CHATM™ SENSOR

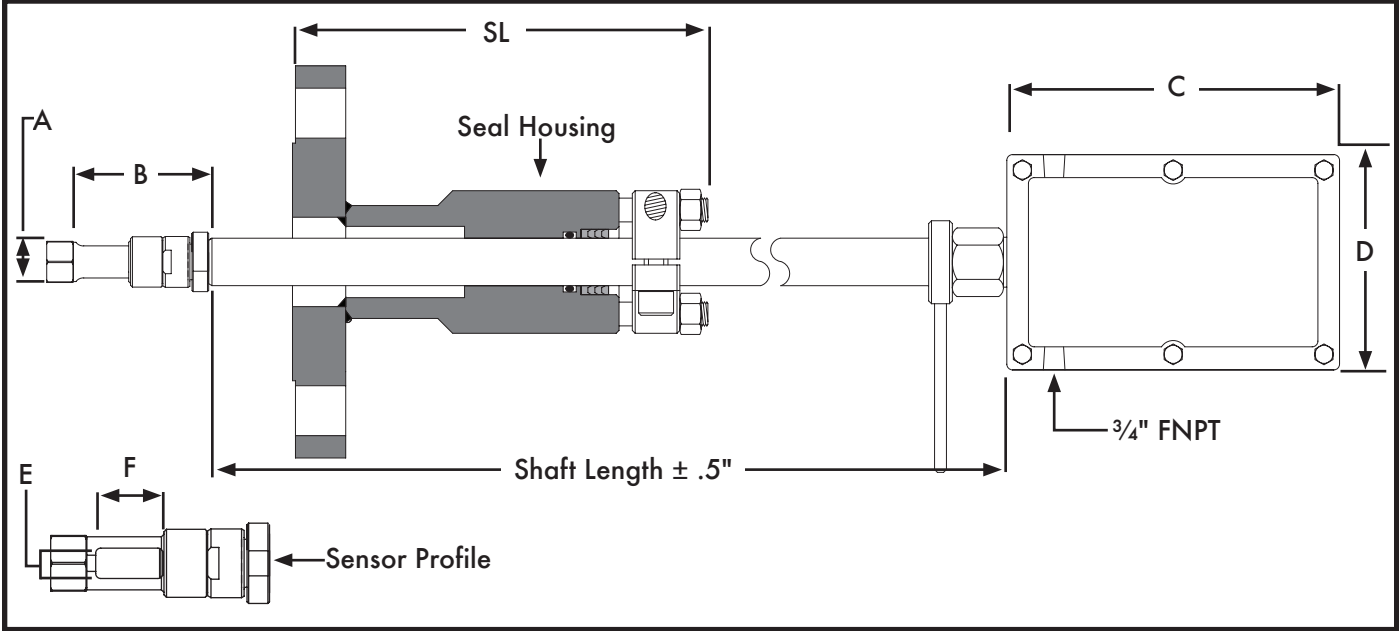


TABLE 2-2 FLANGE SIZE AND CLASS (SL)

| | 150 | | 300 | | 600 | | 900 | |
|---|--------|-----|--------|-----|--------|-----|--------|-----|
| " | INCHES | MM | INCHES | MM | INCHES | MM | INCHES | MM |
| 2 | 8.40 | 213 | 8.50 | 216 | 8.90 | 226 | 9.40 | 240 |
| 3 | 8.60 | 218 | 8.75 | 222 | 9.15 | 232 | 9.40 | 240 |
| 4 | 8.60 | 218 | 8.90 | 226 | 9.40 | 240 | 9.65 | 245 |

TABLE 2-3 DIMENSIONS

| | INCHES | MM | Shaft Lengths are available in .5" (12.7mm) increments. Standard sizes are 24", 30", 36", 48", and 60". (609.6mm, 762mm, 914.4mm, 1219mm, 1524mm) |
|---|--------|-----|--|
| A | 1.25 | 32 | |
| B | 3.5 | 90 | |
| C | 7.25 | 184 | |
| D | 4.7 | 119 | |
| E | .47 | 12 | |
| F | 1 | 25 | |

SPECIFICATIONS CONTINUED

FIG. 2-4 FLOW THROUGH CHA™

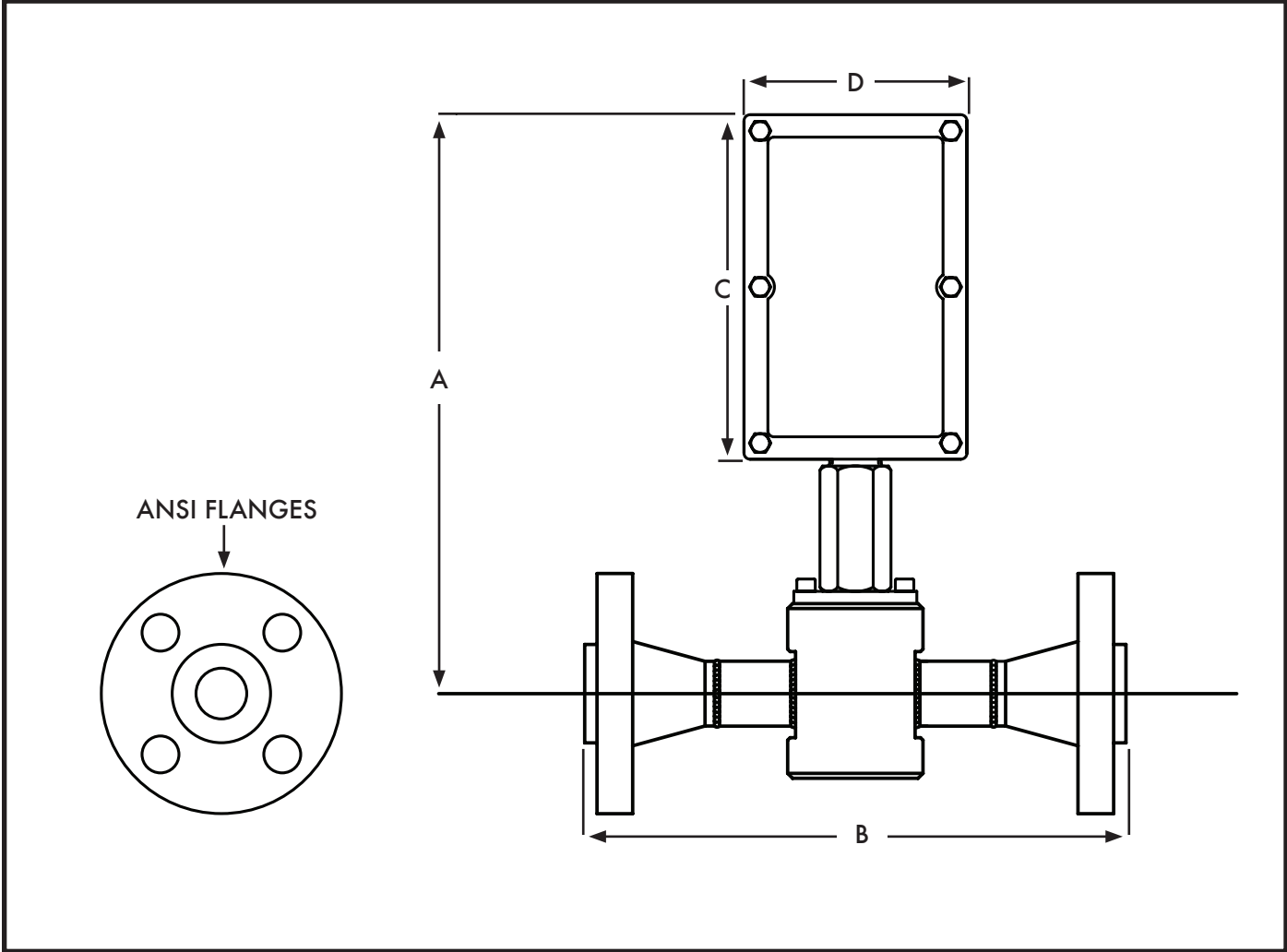


TABLE 2-5 DIMENSIONS

| | INCHES | MM |
|---|--------|-----|
| A | 11.8 | 299 |
| B | 11 | 279 |
| C | 7.25 | 184 |
| D | 4.7 | 119 |

INSTALLATION

PRIOR TO INSTALLATION

Remove all the protective packaging materials , and ensure that the CHA™ sensor was not damaged during transit.

MAIN LINE INSTALLATION

The KAM® CHA™ sensor should be installed according to FIG. 3-1, ideally at the 3 or 9 o'clock position within the pipeline. Installing the instrument horizontally prevents the long-term buildup of any sediment on the sapphire windows. A full-opening ball valve is used to isolate the CHA™ sensor from the pipeline during installation or removal. The seal housing of the CHA™ sensor allows the probe to be inserted and removed from the pipe under pressure and flow conditions. It is the user's responsibility to ensure that the CHA™ sensor be placed at the most representative point within the flow profile. The CHA™ sensor should be inserted so that the window of the probe is fully located within the pipeline.

NOTE: Line pressure must be below 100 psi for CHA installation and removal. Pressure above 100 psi could cause the probe to forcibly move outward from the pipeline risking bodily injury and/or damage to the probe.

1. Prior to mounting verify that the tip of the sensor is all the way inside the seal housing. (FIG. 3-2,3-3)
2. If sensor is not fully enclosed inside the seal housing, pull the shaft back until the probe is all the way in the seal housing and tighten the socket cap screws on the locking collar. This will prevent the CHA™ shaft from sliding and the probe from getting damaged during mounting.

FIG. 3-1 KAM® CHA™ INSTALLED ON A MAIN PIPE

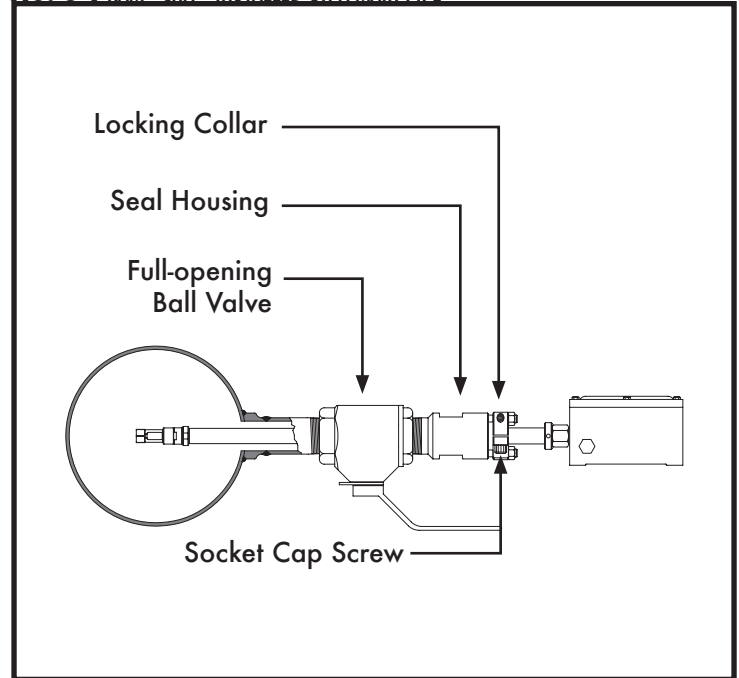


FIG. 3-2

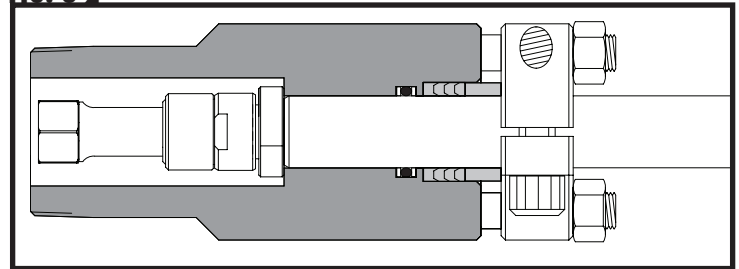
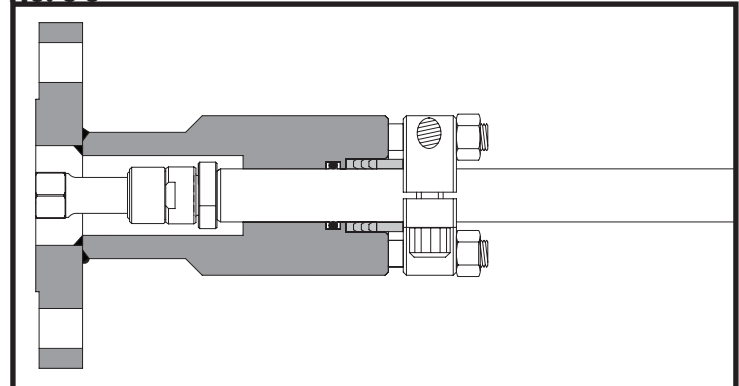


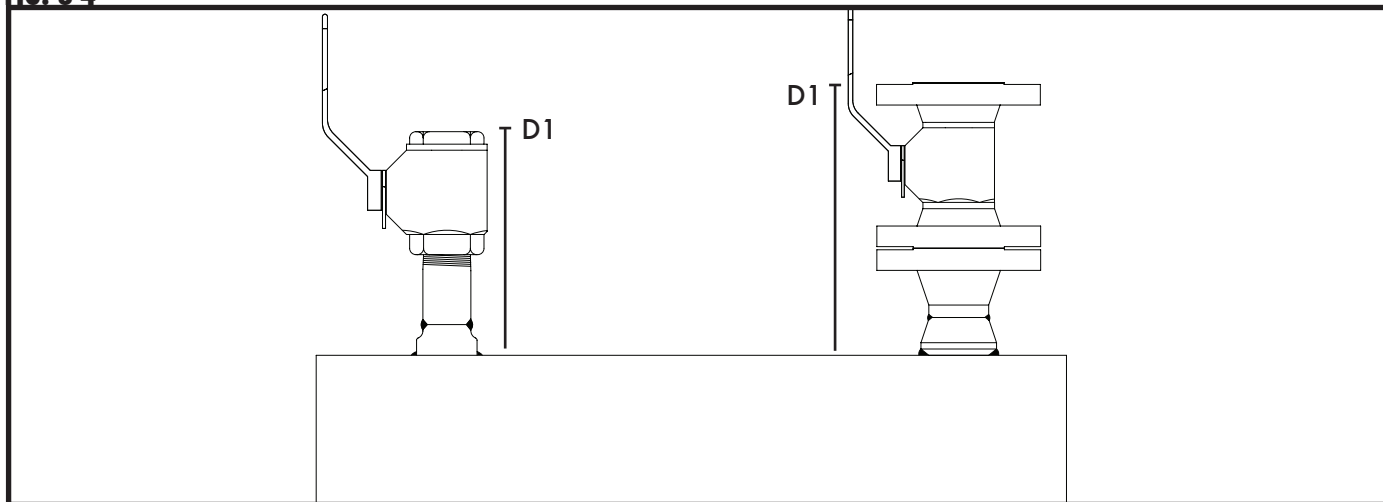
FIG. 3-3



INSTALLATION CONTINUED

3. Measure the distance (D1) from the outside diameter of main pipe to the end of the connection where the CHA™ sensor is going to be installed. FIG. 3-4.

FIG. 3-4



4. Calculate the minimum insertion distance for the CHA.

Minimum insertion distance (MID) = $D1 + \text{Wall Thickness} + 2"$

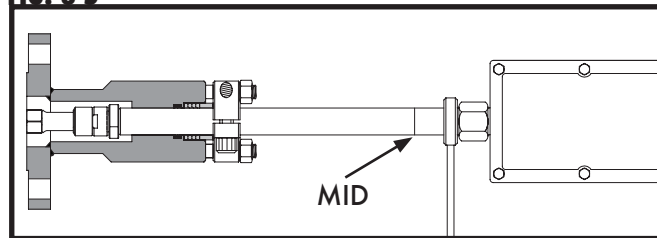
Example for $D1=16"$, pipe $WT = 1/4"$, Seal Thickness= $1/8"$:

$$MID = 16 + 1/4 + 1/8 + 2$$

$$MID = 18 \frac{3}{8}"$$

5. Measure the calculated MID from the top of the seal clamp and place a mark with a permanent marker or tape on the Shaft. FIG. 3-5.

FIG. 3-5



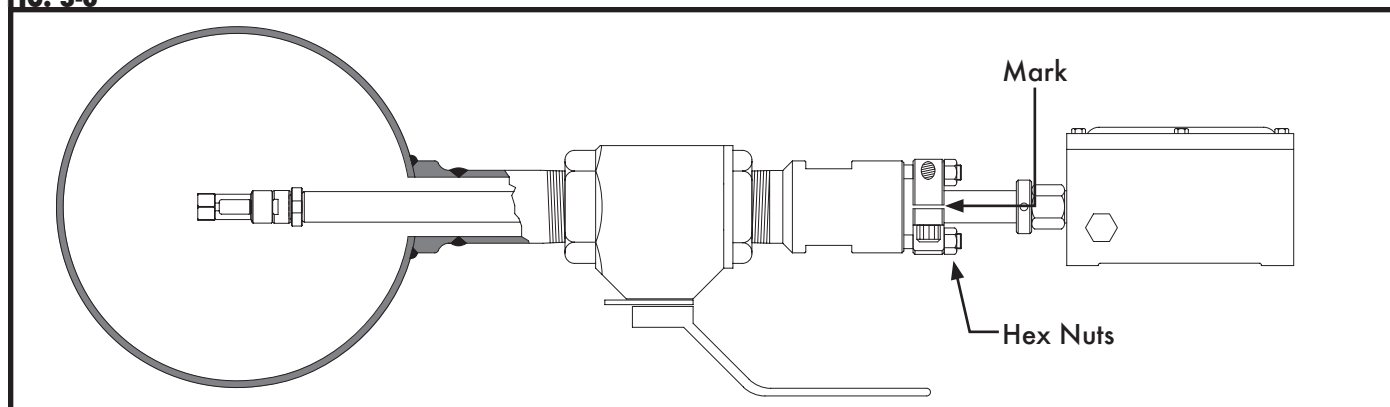
6. Bolt or screw the CHA™ sensor to the valve or designated installation location.
(KAM CONTROLS recommends using thread sealant and not Teflon tape for the threaded CHA™).
7. Open full opening valve.
8. Loosen Socket Cap Screws on the locking collar.

REMINDER: Line pressure must be below 100 psi for CHA installation and removal.

INSTALLATION CONTINUED

9. Push CHA™ sensor in until the mark is at the top edge of the locking collar. Ensure that CHA™ flow indicator is aligned with pipeline flow direction. FIG. 3-6.

FIG. 3-6



10. Re-tighten the Socket Cap Screws with a torque of 750-800 lb-in or 62.5 to 66.6 lb-ft.
11. Tighten the Hex Nuts on the top of the Locking Collar one half turn. These nuts should never be over-tightened. Their major function is to apply light pressure on the chevron packing to ensure a seal between the seal housing body and the insertion shaft.

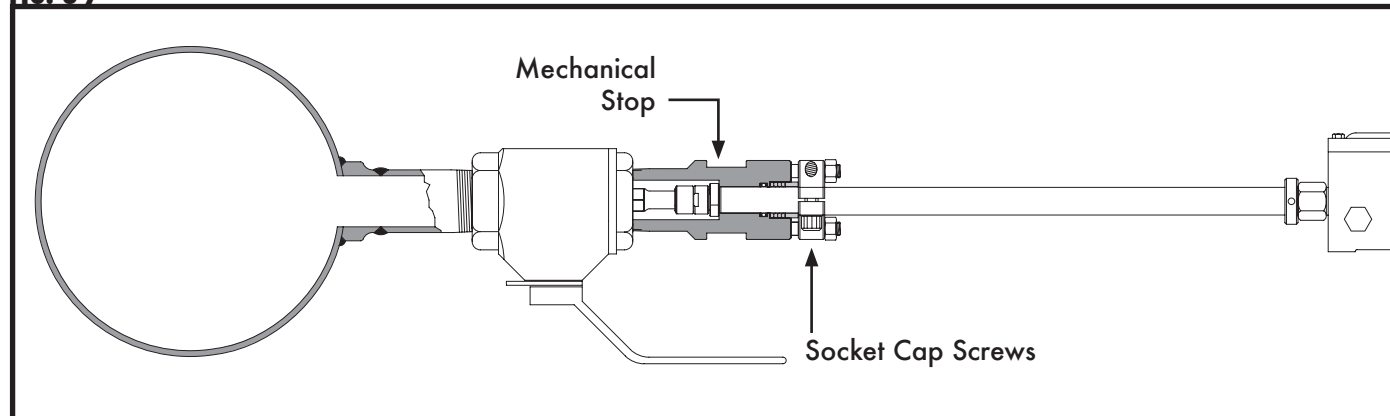
REMOVING THE CHA™ SENSOR

1. To remove the CHA™ sensor, first disconnect all electrical connections to the CHA™ enclosure.
2. Make sure that the line pressure is below 100 psi. Then, slowly and with caution loosen the Socket Cap Screws on the Lock Down Collar.

NOTE: Once the Socket Cap Screws have been loosened, the CHA shaft may push out from the line. If pressure in the line is above 100 psi, it may do so with enough force to cause bodily injury or damage to the instrument.

3. Slide the CHA™ sensor upward until it stops and the probe rests inside the seal housing. Fig. 3-7. The mechanical stop prevents further movement or ejection of the shaft and/or sensor.
4. Next, close the Full-opening Ball Valve tightly. The CHA™ sensor may now be unbolted from the system.

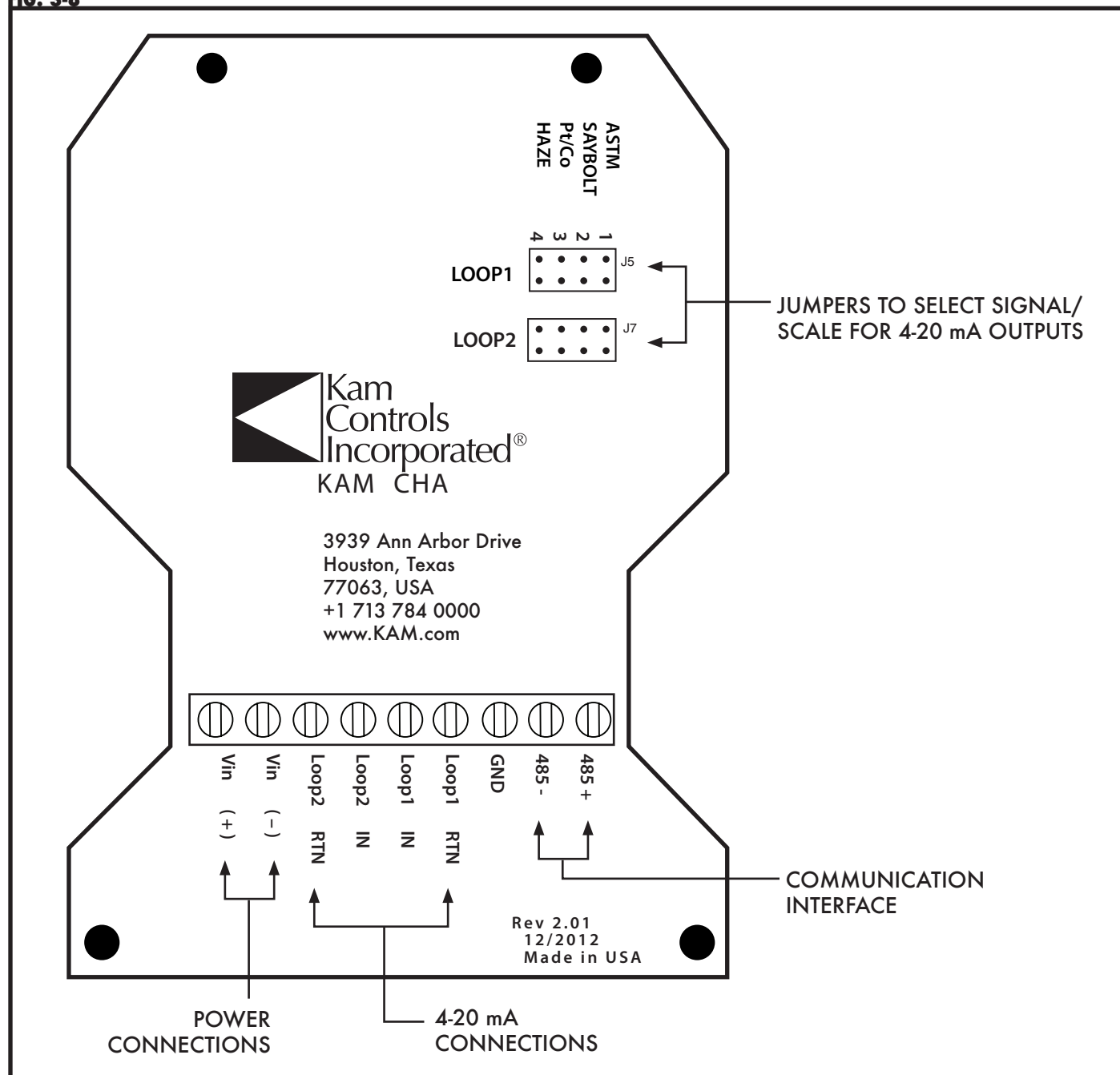
FIG. 3-7



INSTALLATION CONTINUED

WIRING

FIG. 3-8



POWER

12 or 24 VDC (5 watts max)

COMMUNICATION INTERFACE

RS-485

CAUTION: When electronics enclosure is open, be extremely careful to avoid any contact with interior fiber optic connections. Failure to do so could result in the CHA malfunctioning.

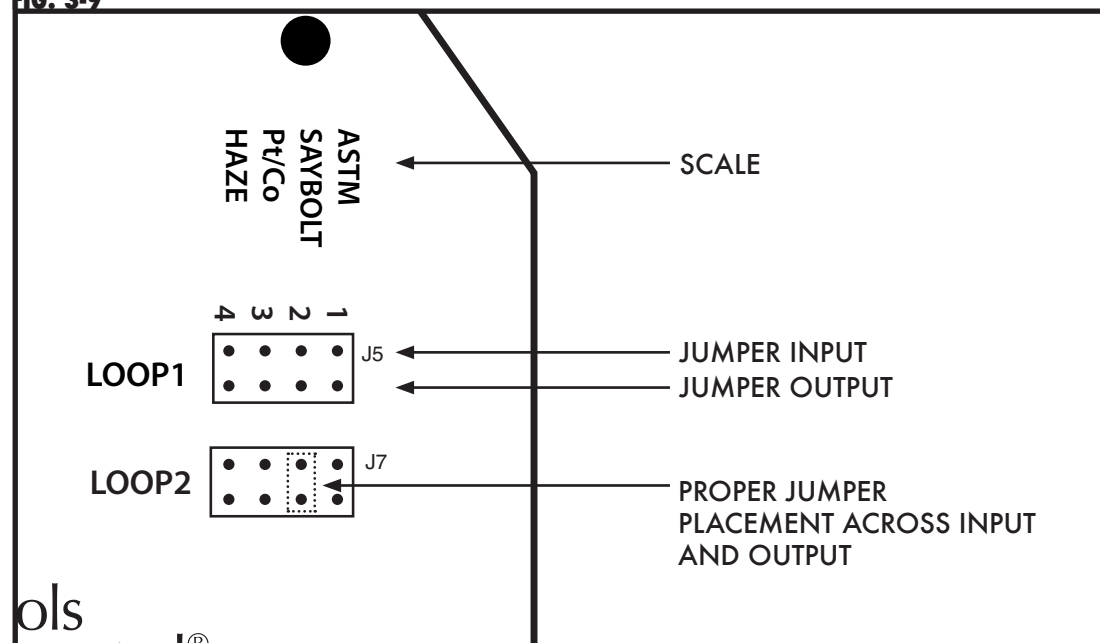
INSTALLATION CONTINUED

OUTPUTS

LOOP1 and LOOP2 can output signals for any 2 of 4 different scales: ASTM, Saybolt, Platinum/Cobalt, and Haze.

To select which signal or scale is associated with which 4-20 mA output, insert a jumper across the pins next to the label for the desired scale. See Fig. 3-9. Place ONE jumper in J5 and one in J7 to select two scales total. Inserting more than one jumper for either LOOP or inserting the jumper across two inputs or two outputs will result in the malfunctioning of the instrument.

FIG. 3-9



COLOR SCALE RANGES

| SCALE | RANGE |
|-----------------|-----------|
| ASTM | .5 to 8 |
| Saybolt | -30 to 16 |
| Platinum/Cobalt | 0 to 500 |
| Haze | 0 to 100 |

MAINTENANCE

CLEANING AND INSPECTION

Under normal operation, the KAM CHA should not require cleaning, unless pipeline usage is limited to a small number of products. Gasoline products or jet fuel in the pipeline will clean the CHA without removal.

To remove any oil residues for visual inspection use a clean cloth with oil solvent or part washer. Preferred solvents include, any petroleum solvent such as mineral spirits, xylene, toluene, gasoline, or diesel. Do not use WD40 or other chemicals.

If you have a question regarding cleaning solvents, please contact KAM CONTROLS directly at +1 713 784-0000, or email: AskAnEngineer@Kam.com

COMMUNICATIONS INTERFACE

HYPERTERMINAL PROMPTS FOR RS-485 CONNECTION

1. Once Hyperterminal software is launched, a dialogue window will prompt you to "Enter a name and choose an icon for the connection." Name the connection whatever you want, for example "CHA 1." Ignore the choose icon option. Hit OK.
2. The "Connect To" dialogue box will now appear. On the last line where it says "Connect using" choose the name of the communication port connected to the CHA via RS-485 from the drop-down menu. Hit OK.
3. The "Port Settings" dialogue box will now appear. Enter the following values from the drop-down menu:

Bits per second: 1200

Data bits: 7

Parity: Even

Stop bits: 2

Flow control: None

Hit OK.

4. A blank screen with prompt will now open. To display CHA readings type one of three prompts, E1, E2, or E3.
E1: Displays values for Z, Y, Z, and T (haze)
E2: Displays values for ASTM, Saybolt, PtCo (Platinum Cobalt), and T (haze)
E3: Displays all values